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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/622,405	08/17/2000	Alan H. Greenaway	124-786	6703

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EXAMINER

AMARI, ALESSANDRO V

ART UNIT	PAPER NUMBER
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2872

DATE MAILED: 12/02/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/622,405

Applicant(s)

GREENAWAY ET AL.

Examiner

Alessandro V. Amari

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 18 September 2002.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-21 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 9 and 19 is/are allowed.
- 6) ☒ Claim(s) 1-8, 10-18, 20 and 21 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ 6) ☐ Other: _____

DETAILED ACTION

Allowable Subject Matter

1. In regard to claims 15-18, allowable subject matter indicated in previous office action (see Paper no.8, dated 18 April 2002) is hereby rescinded. The Office regrets any inconvenience to applicant due to the withdrawal of the indication of allowable subject matter.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 13 and 14 are rejected under 35 U.S.C. 102(b) as being anticipated by Park et al. U.S. Patent 5,526,336.

In regard to claim 13, Park et al. discloses (see Figure 8) an apparatus for producing simultaneously a plurality of spatially separated images from a plurality of object fields, said apparatus comprising, an optical system (5, 22A, 23) arranged to produce an image associated with a first focus condition; a diffraction grating (4') arranged to produce, in concert with the optical system, images associated with each diffraction order and means for detecting the images (11A), wherein the optical system, diffraction grating and detecting means are located on an optical axis as shown in Figure 7 and the diffraction grating is located in a suitable grating plane and is distorted substantially according to a quadratic function so as to cause images to be formed

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under various focus conditions and adapted for forming images on a plurality of image planes (7', 8'), from said plurality of object planes (1A, 1B) as described in column 5, lines 4-32.

Regarding claim 14, Park et al. discloses that at least one of the object planes contains a source of illumination which is used to illuminate the image planes as described in column 5, lines 4-32.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 1, 4, 5, 7, 8, 11-12, 15-18, 20 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kubo U.S. Patent 5,684,762 in view of Shimano et al. U.S. Patent 5,930,220.

In regard to claims 1 and 15, Kubo discloses (see Figure 2) an apparatus for producing simultaneously a plurality of spatially separated images from an object plane or field comprising an optical system (26, 28) arranged to produce an image associated with a first focus condition; a diffraction grating (27) arranged to produce, in concert with the optical system, images associated with each diffraction order as shown in Figures 2 and 5 and means for detecting the images (29), wherein the optical system, diffraction grating and detecting means are located on an optical axis ("O" as shown in Figure 2) and the diffraction grating is located in a suitable grating plane (as shown in Figure 2)

and the diffraction grating is distorted according to a quadratic function as described in column 4, lines 55-63 so as to cause the images to be formed under various focus conditions and said images spatially separated in a direction having a non-zero component perpendicular to the optical axis as is shown in the right side of Figure 2.

In regard to claim 4, Kubo discloses that the origin of the distortion function of the diffraction grating is displaced from the optical axis as described in column 4, lines 39-63 and as shown in Figure 11.

In regard to claim 5, Kubo discloses the origin of the quadratic distortion function is displaced to cause alignment along the optical axis of the images associated with each diffraction order as described in column 4, lines 64-67 and column 5, lines 1-3.

In regard to claim 7, Kubo discloses that the diffraction grating is any one of an amplitude-only diffraction grating, a phase only diffraction grating or a phase and amplitude diffraction grating as described in column 4, lines 28-38.

In regard to claim 11, Kubo discloses that the diffraction grating is a reflective grating or a transmissive grating as described in column 4, lines 28-38 and as shown in Figure 2.

In regard to claim 12, Kubo discloses the grating is any of a two-level (binary) structure, a multi-level (digitised) structure or a continuous-level (analogue) structure as described in column 4, lines 38-54.

Regarding claim 20, Kubo discloses a wavefront analyzer including an apparatus for producing simultaneously a plurality of spatially separated images from an object field as described in column 2, lines 7-29 and as shown in Figure 2.

Regarding claim 21, Kubo discloses a passage ranging device including an apparatus for producing simultaneously a plurality of spatially separated images from an object field as described in column 2, lines 7-29 and as shown in Figure 2.

However, in regard to claims 1 and 15, Kubo does not teach that the apparatus produces the plurality of spatially separated images from a plurality of object planes or that the apparatus is adapted for producing substantially in focus images in a common image plane from a plurality of object planes. Nor in regard to claim 8 does Kubo teach that the diffraction grating is polarization sensitive.

In regard to claim 1, Shimano et al. does teach that the apparatus produces the plurality of spatially separated images in a common image plane from a plurality of object planes as shown in Figure 9.

Regarding claim 8, Shimano et al. teaches that the diffraction grating is polarization sensitive as described in column 5, lines 1-7.

Regarding claim 16, Shimano et al. teaches that the object planes are coincident with the image planes as shown in Figure 9.

Regarding claim 17, Shimano et al. teaches where each object plane contains an array of elements, capable of existing in at least two states and in which the detector means is capable of distinguishing between said states as shown in Figure 3. Inherently, each object plane contains elements (i.e., lands and pits), which exist in two states (1 or 0).

Regarding claim 18, Shimano et al. teaches reading data from a three dimensional optical storage medium wherein object planes are located within the

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medium and the detecting means is capable of producing a signal dependent on the state of the elements as shown in Figure 3 and as described in column 8, lines 46-59.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to utilize the elements of Shimano in the device of Kubo in order to read information from different object fields corresponding to different optical recording media (i.e., CD or DVD).

6. Claims 2, 3 and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kubo U.S. Patent 5,684,762 in view of Shimano et al. U.S. Patent 5,930,220 in view of Lee U.S. Patent 5,721,629.

In regards to claims 2 and 3, the combination teaches the invention as set forth above but does not teach that the function according to which the grating is distorted includes further terms for producing different amounts of spherical aberration in the images associated with each diffraction order nor does the combination teach that the spherical aberration of images associated with each diffraction order is arranged to correct for spherical aberration associated with the different depths of substantially parallel planes in object or image space. Lee teaches that the function according to which the grating is distorted includes further terms for producing different amounts of spherical aberration in the images associated with each diffraction order as described in column 3, lines 35-67. Lee also teaches that the spherical aberration of images associated with each diffraction order is arranged to correct for spherical aberration associated with the different depths of substantially parallel planes in object or image space as described in column 3, lines 35-52. It would have been obvious to one having

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ordinary skill in the art at the time the invention was made to modify the grating of Kubo to correct for spherical aberration as taught by Lee in order to compensate for the spherical aberration caused by the different thicknesses of the optical disk media.

In regard to claim 6, the combination teaches the invention as set forth above but does not teach that the diffraction grating comprises a set of two or more diffraction gratings designed such that the various diffraction orders are spatially separated. Lee does teach (see Figures 7A, 7B, 7C) that the diffraction grating comprises a set of two or more diffraction gratings (27a, 28a) designed such that the various diffraction orders are spatially separated as described in column 3, lines 35-50. It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the combination to incorporate the features of the grating as taught by Lee so that the grating exhibits low aberration.

7. Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kubo U.S. Patent 5,684,762 in view of Shimano et al. U.S. Patent 5,930,220 in view of Torok U.S. Patent 3,861,784.

In regard to claim 10, the combination teaches the invention as set forth above but does not teach that the diffraction grating is a programmable grating.

Torok teaches a diffraction grating that is programmable as described in abstract.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to utilize the programmable grating as taught by Torok in the invention of Kubo in order to provide selectivity of foci for different diffraction orders due to variation in layer thickness of the optical media.

Allowable Subject Matter

8. Claims 9 and 19 are allowable.

9. Claim 9 is allowable over the prior art for at least the reason that the prior art fails to teach or reasonably suggest, "diffraction grating comprises two gratings sensitive to different polarizations" as set forth in the claimed combination.

Claim 19 is allowable over the prior art for at least the reason that the prior art fails to teach or reasonably suggest, "a dispersive system for introducing an offset to an input beam of radiation, said offset being perpendicular to the optical axis and proportional to the wavelength of the input radiation, whilst leaving the beams at each wavelength following parallel paths" as set forth in the claimed combination.

The prior art of record, Kubo, Shimano, Lee and Park et al. teach an apparatus for producing simultaneously a plurality of spatially separated images from an object field and wherein said images are spatially separated in a direction having a non-zero component perpendicular to the optical axis. Park et al. teaches an apparatus for producing simultaneously a plurality of spatially separated images from a plurality of object fields wherein said images are spatially separated. However, neither Kubo, Shimano, Lee or Park et al. teaches that the diffraction grating comprises two gratings sensitive to different polarizations. In addition, Kubo and Shimano teach an apparatus for producing simultaneously a plurality of spatially separated images from a plurality of object planes but does not teach a dispersive system for introducing an offset to an input beam of radiation, said offset being perpendicular to the optical axis and proportional to the wavelength of the input radiation, whilst leaving the beams at each

wavelength following parallel paths and no motivation or teaching is present to modify this difference as derived.

Response to Arguments

10. Applicant's arguments filed 18 September 2002 have been fully considered but they are not persuasive.

In regard to claims 13 and 14, the applicant argues that Park does not teach the claimed diffraction grating.

In response to this argument, the examiner would like to refer the applicant to Park et al., column 5, lines 47-48 which clearly refers to a "diffraction optical element".

In regard to claims 13 and 14, the applicant further argues that there is no effect of the diffraction grating on the image split at beam splitter 21 onto two different detectors 11a and 11b and therefore, the structure of Park does not meet the applicant's claim language requiring the recited "means for detecting" which forms images on a plurality of image planes from a plurality of object planes.

In response to this argument, the examiner would like to point out that the rejection is based upon the claim recitation. All the claim requires is that there be a means for detecting the images (see element 11A in Figure 8) and that the optical system (5, 22A, 23), diffraction grating (4') and detecting means be located on an optical axis as shown in Figure 8 with the diffraction grating located in a suitable grating plane and distorted according to a quadratic function and wherein said images are spatially separated in a direction having a non-zero component perpendicular to the optical axis for producing substantially in focus images in a common image plane from a

plurality of object planes (1A, 1B) as is clearly shown in Figure 8. There is no other relationship or limitation claimed between the diffraction grating and the detecting means.

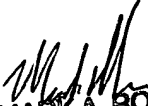
Applicant's arguments with respect to claims 1-8, 10-12, 20 and 21 have been considered but are moot in view of the new ground(s) of rejection.

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Alessandro V. Amari whose telephone number is (703) 306-0533. The examiner can normally be reached on Monday-Friday 8:00 AM to 5:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Cassandra Spyrou can be reached on (703) 308-1687. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9318 for regular communications and (703) 872-9319 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

ava CAV
November 25, 2002


MARK A. ROBINSON
PRIMARY EXAMINER